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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/813,317	03/30/2004	Christoph Schwan	2000.111000	3649

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EXAMINER
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TRINH, MICHAEL MANH

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 10/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/813,317

Applicant(s)

SCHWAN, CHRISTOPH

Examiner

Michael Trinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 12 July 2004 IDS.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-36 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-36 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>7-12-2004</u> . | 6) <input type="checkbox"/> Other: _____  |

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## DETAILED ACTION

\*\*\* This office action is in response to filing of the application on March 30, 2004. Claims 1-36 are pending.

### *Claim Rejections - 35 USC § 112*

1. Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 11, "said second etch stop layer" lacks proper antecedent basis.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

3. Claims 1-8,10-17,21-23,27-36 are rejected under 35 U.S.C. 102(b) as being anticipated by Bae et al (2002/0182795).

Re claim 1, Bae teaches (at Figs 6-10; pages 3-4) a method for forming spacer elements, the method comprising: forming a conductive line 120 above a semiconductor region 100 (Fig 6; paragraph 0034); conformally forming a spacer layer stack over said conductive line and said semiconductor region, said spacer layer stack comprising an etch stop layer 150 separating a first spacer layer 140 from a second spacer layer 160 formed above said first spacer layer 140, said first and second spacer layers comprised of a material that may be etched selectively to said etch stop layer 150 by a predefined etch chemistry (Fig 6, paragraph 0034); anisotropically etching said second spacer layer 160 to form sacrificial sidewall spacers 161 (Fig 7, paragraphs 0036-0038); removing portions of said etch stop layer 150 that are exposed during the formation of said sacrificial sidewall spacers 161 (Fig 7); and removing said sacrificial sidewall spacers 161

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and exposed portions of said first spacer layer 140 by an etch process using said specified etch chemistry to form said spacer elements 142 (Figs 8-9; paragraphs 0039-0042; 0045-0049). Re claim 21, Bae also teaches (at Figs 6-10; pages 3-4) a method for forming spacer elements, the method comprising: forming a conductive line 120 above a semiconductor region 100 (Fig 6; paragraph 0034); conformally forming a spacer layer stack over said conductive line and said semiconductor region, said spacer layer stack comprising a first etch stop layer 130 formed of a first material, a first spacer layer 140 of a second material, a second etch stop layer 150 formed of the first material, and a second spacer layer 160 formed of the second material (Figs 6-8, paragraphs 0034-0036); forming sacrificial sidewall spacers 161 at least from the second spacer layer 160 (Fig 7, paragraphs 0036-0038); forming the spacer elements 142 at least from the first spacer layer 140 by removing the sacrificial spacers 161 (Figs 8-9; paragraphs 0039-0042; 0046-0049).

Re claim 2, wherein said sacrificial sidewall spacers 161 and exposed portions of said first spacer layer 142 are removed by a common etch process (Figs 7-8; paragraphs 0039, 0036-0040). Re claim 3, further comprising forming a second etch stop layer 130 under said spacer layer stack (Figs 6-7; paragraphs 0034-0036). Re claim 4, wherein said second etch stop layer 150 is comprised of the same material as said etch stop layer 130 (Fig 6, paragraph 0034). Re claim 5, further comprising removing exposed portions of said second etch stop layer 130 (Fig 9, paragraphs 0046-0047). Re claim 6, wherein said sacrificial sidewall spacers 161 and exposed portions of said first spacer layer 140 are removed by an isotropic etch process (Fig 8; paragraph 0039). Re claim 7, wherein said first and second spacer layers 140 and 160 are comprised of substantially the same material (paragraph 0034; Fig 6). Re claim 8, wherein said first and second spacer layers 140, 160 are comprised of silicon nitride (paragraph 0034). Re claim 10, wherein said etch stop layer 150 is comprised of silicon dioxide (paragraph 0034). Re claim 11, wherein a second etch stop layer 130 is comprised of silicon dioxide (paragraph 0034). Re claims 12, 30, wherein a degree of recessing said first spacer layer 142 with respect to a top surface of said conductive line 120 is inherently controlled by correspondingly adjusting at least one process parameter of the isotropic etch process that is necessarily needed and predetermined during the removal of the sacrificial spacers 161 (Figure, 8 paragraphs 0039-0042). Re claims 13, 31 wherein the at least one process parameter represents at least one of an

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etch chemistry and an etch time that is necessarily needed and predetermined during the isotropic etching to remove the sacrificial spacer 161 (Fig 8, paragraphs 0039-0042). Re claims 14,32, wherein anisotropically etching said second spacer layer 160 to form sacrificial sidewall spacers 161, removing portions of said etch stop layer 150 that are exposed during the formation of said sacrificial sidewall spacers 161 (paragraphs 0035-0038), and removing said sacrificial sidewall spacers 161 and exposed portions of said first spacer layer 140 by a common etch process of isotropic etching using said specified etch chemistry performed as an in situ process (paragraphs 0039-0040). Re claims 15,33, wherein a length of said conformal spacer element 142 is adjusted due to the controlled and predetermined thickness of said second spacer layer 160 in a range of thickness (Figs 6-9; paragraphs 0034-0039; 0046-0048). Re claim 34, wherein a length of said conformal spacer element 142 is adjusted due to the controlled and predetermined of at least one process parameter of the isotropic etch process that is necessarily needed and predetermined during the removal of the sacrificial spacers 161 (Figure, 8 paragraphs 0039-0042). Re claims 16,35 adjusting a thickness of said conformal spacer element 142 is adjusted due to the controlled and predetermined thickness of said first spacer layer 140 in a range of thickness (Figs 6-9; paragraphs 0034-0039; 0046-0048). Re claims 17,36 wherein said conductive line 120 represents a gate electrode of a field effect transistor receiving a lateral drain and source 180 dopant profile that is controllable by the thickness and the length of said conformal spacer element 142 (Figs 9;6, paragraphs 0034, 0043-0049). Re claim 22, wherein said second material 140,160 comprises silicon nitride (Fig 6, paragraph 0034). Re claim 23, wherein said first material comprises silicon dioxide (Fig 6, paragraph 0034). Re claim 27, wherein said sacrificial sidewall spacers 161 and exposed portions of said first spacer layer 140 are removed by a common etch process (Figs 7-8; paragraph 0039). Re claim 28, further comprising removing exposed portions of said first and second etch stop layers 130,150 (Figs 7-9; paragraphs 0035-0039; 0046-0048). Re claim 29, wherein said sacrificial sidewall spacers 161 and exposed portions of said first spacer layer 140 are removed by an isotropic etch process (Fig 8, paragraph 0039).

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 9,24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bae et al (2002/0182795) taken with Lin et al (6,534,388).

Bae teaches (at Figs 6-10; paragraphs 0034-0048) a method for forming spacer elements, as applied to claims 1-8,10-17,21-23,27-36 above.

Re claims 9,24, Bae lacks mentioning forming the spacer layers by plasma enhanced CVD.

However, Lin teaches (at col 3, lines 30-50) depositing the spacer layers by plasma enhanced chemical vapor deposition (PECVD).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the first and second spacer layers of Bae by plasma enhanced chemical vapor deposition as taught by Lin. This is because PECVD is one of the effective and proven processes depositing a conformal and excellent spacer insulating layers on the conductive lines.

6. Claims 18-20,25,26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bae et al (2002/0182795) taken with Lin et al (6,534,388).

Bae teaches (at Figs 6-10; paragraphs 0034-0048) a method for forming spacer elements, as applied to claims 1-8,10-17,21-23,27-36 above. Re further claim 19, wherein the thickness of said etch stop layer 150 is predeterminedly selected on the basis of a height of said line 120 and an etch selectivity process during the removal of the spacers (Figs 6-9; paragraphs 0034-0039; 0046-0048).

Re claims 18-20,25-26, Bae lacks mentioning to remove the sacrificial spacers, at least partially, by an anisotropic etch process.

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However, Chen teaches (at Figures 6-7; col 4, lines 43-52; line 64 through col 7, line 8) to remove the sacrificial spacers 22 (Figs 7-8), at least partially, by an anisotropic etch process.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the first and second spacer layers of Bae by plasma enhanced chemical vapor deposition as taught by Chen. This is because of the desirability to remove the sacrificial spacers by using the a common etching techniques as to reduce production cost and simplify processing steps.


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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272-1847. The examiner can normally be reached on M-F: 8:30 Am to 5:00 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number is (571) 273-8300.

Any inquiry of a general nature or relating to the status of this application should be directed to the receptionist whose telephone number is (703) 308-0956.

Oacs-18

  
Michael Trinh  
Primary Examiner